

1      **CLAIMS:**

2      1. A conductive integrated circuit metal alloy interconnection  
3      comprising an alloy of copper and silver, with silver being present in  
4      the alloy at from less than 1.0 at% to 0.001 at%.

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6      2. The interconnection of claim 1 wherein silver is present in  
7      the alloy at from 0.005 at% to 0.1 at%.

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9      3. The interconnection of claim 1 having higher electromigration  
10     resistance than copper of a purity of greater than 99.999% of the same  
11     grain size.

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13     4. The interconnection of claim 1 having greater thermal  
14     stability to grain size retention and crystal orientation retention than  
15     copper of a purity of greater than 99.999% of the same grain size.

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17     5. A physical vapor deposition target comprising an alloy of  
18     copper and silver, with silver being present in the alloy at from less  
19     than 1.0 at% to 0.001 at%.

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21     6. The physical vapor deposition target of claim 5 wherein  
22     silver is present in the alloy at from 0.005 at% to 0.1 at%.

1           7. The physical vapor deposition target of claim 5 comprising  
2           an RF sputtering coil.

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4           8. An electroplating anode comprising an alloy of copper and  
5           silver, with silver being present in the alloy at from less than 1.0 at%  
6           to 0.001 at%.

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8           9. The electroplating anode of claim 8 wherein silver is present  
9           in the alloy at from 0.005 at% to 0.1 at%.

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11          10. A metal alloy for use as a conductive interconnection in an  
12          integrated circuit comprising copper and silver, with silver being present  
13          in the alloy at from less than 1.0 at% to 0.001 at%.

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15          11. The metal alloy of claim 10 wherein silver is present in the  
16          alloy at from 0.005 at% to 0.1 at%.

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18          12. A conductive integrated circuit metal alloy interconnection  
19          comprising an alloy of copper and silver, with silver being present in  
20          the alloy at from 50 at% to 70 at%.

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22          13. The interconnection of claim 12 wherein silver is present in  
23          the alloy at from 55 at% to 65 at%.

1        14. The interconnection of claim 12 wherein silver is present in  
2        the alloy at about 60 at%.

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4        15. The interconnection of claim 12 having higher  
5        electromigration resistance than copper of a purity of greater than  
6        99.999% of the same grain size.

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8        16. The interconnection of claim 12 having greater thermal  
9        stability to grain size retention and crystal orientation retention than  
10      copper of a purity of greater than 99.999% of the same grain size.

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12      17. A physical vapor deposition target comprising an alloy of  
13      copper and silver, with silver being present in the alloy at from 50 at%  
14      to 70 at%.

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16      18. The physical vapor deposition target of claim 17 wherein  
17      silver is present in the alloy at from 55 at% to 65 at%.

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19      19. The physical vapor deposition target of claim 17 wherein  
20      silver is present in the alloy at about 60 at%.

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22      20. The physical vapor deposition target of claim 17 comprising  
23      an RF sputtering coil.

1           21. An electroplating anode comprising an alloy of copper and  
2           silver, with silver being present in the alloy at from 50 at% to 70 at%.

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4           22. The electroplating anode of claim 21 wherein silver is  
5           present in the alloy at from 55 at% to 65 at%.

6  
7           23. The electroplating anode of claim 21 wherein silver is  
8           present in the alloy at about 60 at%.

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10          24. A metal alloy for use as a conductive interconnection in an  
11          integrated circuit comprising copper and silver, with silver being present  
12          in the alloy at from 50 at% to 70 at%.

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14          25. The metal alloy of claim 24 wherein silver is present in the  
15          alloy at from 55 at% to 65 at%.

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17          26. A conductive integrated circuit metal alloy interconnection  
18          comprising an alloy of copper and tin, with tin being present in the  
19          alloy at from less than 1.0 at% to 0.001 at%.

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21          27. The interconnection of claim 26 wherein tin is present in  
22          the alloy at from 0.01 at% to 0.1 at%.

1           28. The interconnection of claim 26 having higher  
2           electromigration resistance than copper of a purity of greater than  
3           99.999% of the same grain size.

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5           29. The interconnection of claim 26 having greater thermal  
6           stability to grain size retention and crystal orientation retention than  
7           copper of a purity of greater than 99.999% of the same grain size.

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9           30. The interconnection of claim 26 having an electrical  
10          resistivity of less than 1.8 microohms.cm.

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12          31. A physical vapor deposition target comprising an alloy of  
13          copper and tin, with tin being present in the alloy at from less than  
14          1.0 at% to 0.001 at%.

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16          32. The physical vapor deposition target of claim 31 wherein tin  
17          is present in the alloy at from 0.01 at% to 0.1 at%.

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19          33. The physical vapor deposition target of claim 31 comprising  
20          an RF sputtering coil.

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22          34. An electroplating anode comprising an alloy of copper and  
23          tin, with tin being present in the alloy at from less than 1.0 at% to  
24          0.001 at%.

1           35. The electroplating anode of claim 34 wherein tin is present  
2           in the alloy at from 0.01 at% to 0.1 at%.

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4           36. A metal alloy for use as a conductive interconnection in an  
5           integrated circuit comprising copper and tin, with tin being present in  
6           the alloy at from less than 1.0 at% to 0.001 at%.

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8           37. The metal alloy of claim 36 wherein tin is present in the  
9           alloy at from 0.01 at% to 0.1 at%.

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11          38. A conductive integrated circuit metal alloy interconnection  
12          comprising an alloy of copper and one or more other elements, the one  
13          or more other elements being present in the alloy at a total  
14          concentration from less than 1.0 at% to 0.001 at% and being selected  
15          from the group consisting of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd,  
16          Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd,  
17          B, Ga, In, C, Se, and Te.

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19          39. The interconnection of claim 38 wherein the one or more  
20          other elements are present in the alloy at a total concentration from  
21          0.005 at% to 0.1 at%.

1       40. The interconnection of claim 38 having higher  
2 electromigration resistance than copper of a purity of greater than  
3 99.999% of the same grain size.

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5       41. The interconnection of claim 38 having greater thermal  
6 stability to grain size retention and crystal orientation retention than  
7 copper of a purity of greater than 99.999% of the same grain size.

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9       42. A physical vapor deposition target comprising an alloy of  
10 copper and one or more other elements, the one or more other  
11 elements being present in the alloy at a total concentration from less  
12 than 1.0 at% to 0.001 at% and being selected from the group consisting  
13 of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy,  
14 Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd, B, Ga, In, C, Se, and Te.

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16       43. The physical vapor deposition target of claim 42 wherein the  
17 one or more other elements are present in the alloy at a total  
18 concentration at from 0.005 at% to 0.1 at%.

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20       44. The physical vapor deposition target of claim 42 comprising  
21 an RF sputtering coil.

1           45. An electroplating anode comprising an alloy of copper and  
2           one or more other elements, the one or more other elements being  
3           present in the alloy at a total concentration from less than 1.0 at% to  
4           0.001 at% and being selected from the group consisting of Be, Ca, Sr,  
5           Ba, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
6           Lu, Ti, Zr, Hf, Zn, Cd, B, Ga, In, C, Se, and Te.

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8           46. The electroplating anode of claim 45 wherein the one or  
9           more other elements are present in the alloy at a total concentration  
10          at from 0.005 at% to 0.1 at%.

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12          47. A metal alloy for use as a conductive interconnection in an  
13          integrated circuit comprising copper and one or more other elements,  
14          the one or more other elements being present in the alloy at a total  
15          concentration from less than 1.0 at% to 0.001 at% and being selected  
16          from the group consisting of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd,  
17          Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd,  
18          B, Ga, In, C, Se, and Te.

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20          48. The metal alloy of claim 47 wherein the one or more other  
21          elements are present in the alloy at a total concentration from 0.005  
22          at% to 0.1 at%.

1       49. A conductive integrated circuit metal alloy interconnection  
2 comprising an alloy of copper and one or more other elements, the one  
3 or more other elements being present in the alloy at a total  
4 concentration from less than 1.0 at% to 0.001 at% and being selected  
5 from the group consisting of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe,  
6 Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and Pb.

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8       50. The interconnection of claim 49 wherein the one or more  
9 other elements are present in the alloy at a total concentration from  
10 0.005 at% to 0.1 at%.

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12       51. The interconnection of claim 49 having higher  
13 electromigration resistance than copper of a purity of greater than  
14 99.999% of the same grain size.

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16       52. The interconnection of claim 49 having greater thermal  
17 stability to grain size retention and crystal orientation retention than  
18 copper of a purity of greater than 99.999% of the same grain size.

1       53. A physical vapor deposition target comprising an alloy of  
2 copper and one or more other elements, the one or more other  
3 elements being present in the alloy at a total concentration from less  
4 than 1.0 at% to 0.001 at% and being selected from the group consisting  
5 of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ni, Pd,  
6 Pt, Au, Tl, and Pb,

7  
8       54. The physical vapor deposition target of claim 53 wherein the  
9 one or more other elements are present in the alloy at a total  
10 concentration at from 0.005 at% to 0.1 at%.

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12       55. The physical vapor deposition target of claim 53 comprising  
13 an RF sputtering coil.

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15       56. An electroplating anode comprising an alloy of copper and  
16 one or more other elements, the one or more other elements being  
17 present in the alloy at a total concentration from less than 1.0 at% to  
18 0.001 at% and being selected from the group consisting of V, Nb, Ta,  
19 Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and  
20 Pb.

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22       57. The electroplating anode of claim 56 wherein the one or  
23 more other elements are present in the alloy at a total concentration  
24 at from 0.005 at% to 0.1 at%.

1           58. A conductive integrated circuit metal alloy interconnection  
2 comprising an alloy of copper and one or more other elements, the one  
3 or more other elements being present in the alloy at a total  
4 concentration from less than 1.0 at% to 0.001 at% and being selected  
5 from the group consisting of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe,  
6 Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and Pb.

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8           59. The interconnection of claim 58 wherein the one or more  
9 other elements are present in the alloy at a total concentration from  
10 0.005 at% to 0.1 at%.

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